

14 Rec'd PCT/PTO 18 DEC 2001

FORM PTO 1590
(REV 5-98)

US DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY DOCKET NUMBER
2001_1826A

TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. §371

U.S. APPLICATION NO.
(If filed, enter PCT No.)
NEW 067018174

International Application No.
PCT/NO00/00221

International Filing Date
June 26, 2000

Priority Date Claimed
June 25, 1999

Title of Invention

EQUIPMENT FOR CONTINUOUS, HORIZONTAL CASTING OF METAL

Applicant(s) For DO/EO/US


Inge JOHANSEN, Geir MÆLAND and Åge STRØMSVÅG

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. §371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. §371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. §371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. §371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☐ A copy of the International Application as filed (35 U.S.C. §371(c)(2))
 - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☒ has been transmitted by the International Bureau. **ATTACHMENT A**
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C. §371(c)(2)). **ATTACHMENT B**
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. §371(c)(3)).
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19.
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. §371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. §371(c)(5)).

Items 11. to 14. below concern other document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98. **ATTACHMENT D**
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment. **ATTACHMENT E**
☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. ☒ Other items or information:
Unexecuted Declaration and Power of Attorney along with cover letter - **ATTACHMENT C**
 FORM PCT/IPEA/409 - **ATTACHMENT F**
 FORM PCT/IB/304 - **ATTACHMENT G**

U.S. APPLICATION NO. 10/018174 NEW		INTERNATIONAL APPLICATION NO. PCT/NO00/00221		ATTORNEY'S DOCKET NO. 2001 1826A	
15. [X] The following fees are submitted				CALCULATIONS	PTO USE ONLY
BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5)): Neither international preliminary examination fee nor international search fee paid to USPTO and International Search Report not prepared by the EPO or IPO \$1040.00 International Search Report has been prepared by the EPO or IPO \$ 890.00 International preliminary examination fee not paid to USPTO but international search paid to USPTO \$ 740.00 International preliminary examination fee paid to USPTO but claims did not satisfy provisions of PCT Article 33(1)-(4) \$ 690.00 International preliminary examination fee paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) \$ 100.00				\$1,040.00	
ENTER APPROPRIATE BASIC FEE AMOUNT =					
Surcharge of \$130.00 for furnishing the oath or declaration later than [] 20 [] 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				\$	
Claims	Number Filed	Number Extra	Rate		
Total Claims	10 -20 =	-0-	X \$18.00	\$	
Independent Claims	1 - 3 =	-0-	X \$84.00	\$	
Multiple dependent claim(s) (if applicable)			+ \$280.00	\$	
TOTAL OF ABOVE CALCULATIONS =				\$1,040.00	
<input type="checkbox"/> Small Entity Status is hereby asserted. Above fees are reduced by 1/2.				\$	
SUBTOTAL =				\$1,040.00	
Processing fee of \$130.00 for furnishing the English translation later than [] 20 [] 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				+ \$	
TOTAL NATIONAL FEE =				\$1,040.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40 per property +				\$	
TOTAL FEES ENCLOSED =				\$1,040.00	
				Amount to be refunded	\$
				Amount to be charged	\$
i. [X] A check in the amount of \$1,040.00 to cover the above fees is enclosed. A duplicate copy of this form is enclosed. b. [] Please charge my Deposit Account No. 23-0975 in the amount of \$_____ to cover the above fees. A duplicate copy of this sheet is enclosed. c. [] The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 23-0975.					
NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.					
19. CORRESPONDENCE ADDRESS <div style="text-align: center;">  000513 PATENT TRADEMARK OFFICE </div>			By: <u>Michael S. Huppert</u> Michael S. Huppert, Registration No. 40,268 WENDEROTH, LIND & PONACK, L.L.P. 2033 "K" Street, N.W., Suite 800 Washington, D.C. 20006-1021 Phone: (202) 721-8200 Fax: (202) 721-8250 December 18, 2001		

[CHECK NO. 48016]

[2001_1826A]

10/018174

JC06 Rec'd PCT/PTC 1 8 DEC 2001

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of :
Inge JOHANSEN et al. : Attn: BOX PCT
Serial No. NEW : Docket No. 2001_1826A
Filed December 18, 2001 :

EQUIPMENT FOR CONTINUOUS,
HORIZONTAL CASTING OF METAL
[Corresponding to PCT/NO00/00221
Filed June 26, 2000]

THE COMMISSIONER IS AUTHORIZED
TO CHARGE ANY DEFICIENCY IN THE
FEE FOR THIS PAPER TO DEPOSIT
ACCOUNT NO. 23-0975.

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents,
Washington, DC 20231

Sir:

**Prior to initial examination of the above-identified application, kindly amend
the application as follows:**

IN THE CLAIMS:

Kindly amend claims 4 and 5 as follows:

4.(Amended) Equipment in accordance with claim 1, characterised in that the gas is supplied through the permeable material (through 12) in the area closer to the plate 19, while the oil is supplied through the material in the area further from (through 11) the plate (19).

5.(Amended) Equipment in accordance with claim 1, characterised in that a drainage bore or channel (29) is provided in the upper part of the mould cavity to drain out excess gas.

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Kindly add the following new claims:

6.(NEW) Equipment in accordance with claim 2, characterised in that the gas is supplied through the permeable material (through 12) in the area closer to the plate 19, while the oil is supplied through the material in the area further from (through 11) the plate (19).

7.(NEW) Equipment in accordance with claim 3, characterised in that the gas is supplied through the permeable material (through 12) in the area closer to the plate 19, while the oil is supplied through the material in the area further from (through 11) the plate (19).

8.(NEW) Equipment in accordance with claim 2, characterised in that a drainage bore or channel (29) is provided in the upper part of the mould cavity to drain out excess gas.

9.(NEW) Equipment in accordance with claim 3, characterised in that a drainage bore or channel (29) is provided in the upper part of the mould cavity to drain out excess gas.

10.(NEW) Equipment in accordance with claim 4, characterised in that a drainage bore or channel (29) is provided in the upper part of the mould cavity to drain out excess gas.

REMARKS

The present Preliminary Amendment is submitted to delete the multiple dependencies of claims 4 and 5, thereby placing such claims in condition for examination and reducing the required PTO filing fee.

A copy of the amended portion of the claims with changes marked therein is attached and entitled "*Version with Markings to Show Changes Made.*"

Respectfully submitted,

Inge JOHANSEN et al.

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December 18, 2001

Version with Markings to
Show Changes Made

Version with Markings to
Show Changes Made

Claims

1. Equipment for continuous, horizontal casting of metal, in particular aluminium, the equipment including an insulated reservoir or pool (2), which is designed to contain liquid metal, and a mould (3), which can be removed from the pool (2), with an insulating plate (19) with holes (25, 26) which communicate with the mould, the mould (3) including a preferably circular cavity (17) with a wall (12, 13) of permeable material for the supply of oil and at least one annular slit or nozzles (16) arranged along the circumference of the cavity for the direct supply of coolant,

characterised in that in addition to the oil gas is supplied through the permeable material (12,13) and that annuli (20) are arranged between the permeable wall material and the mould housing (8) to distribute the gas/oil to the wall material where the annuli (20) is divided into sectors using plugs or similar restrictions (21) and are supplied with oil/gas via separate supply channels (10, 11) for each sector, thus making it possible to differentiate the supply of oil/gas around the circumference.

2. Equipment in accordance with claim 1,

characterised in that the wall material comprises two rings (10, 11) which are physically separated by means of a gasket (18) or similar.

3. Equipment in accordance with claim 1,

characterised in that each of the annuli (20) are split into two sectors, and upper and lower sector.

(Amended)
4. Equipment in accordance with [the preceding] claims ~~1-3~~

characterised in that the gas is supplied through the permeable material (through 12) in the area closer to the plate 19, while the oil is supplied through the material in the area further from (through 11) the plate (19).

(Amended)
5. Equipment in accordance with [the preceding] claims ~~1-4~~

characterised in that a drainage bore or channel (29) is provided in the upper part of the mould cavity to drain out excess gas.

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EQUIPMENT FOR CONTINUOUS, HORIZONTAL CASTING OF METAL.

The present invention concerns equipment for continuous, horizontal casting of metal, in particular aluminium, including an insulated reservoir or pool, which is designed to contain liquid metal, and a mould, which can be removed from the pool, with an insulating plate with holes which communicate with the mould. The mould includes a preferably circular cavity with wall material of permeable material, for example graphite, for the supply of oil and at least one tubular die arranged along the circumference of the cavity for the direct supply of coolant.

As stated above, directly cooled horizontal casting equipment for continuous casting of metal in which oil is supplied through the cavity wall through an annulus or a permeable wall element in order to form a lubricant film between the mould wall and the metal is already known.

Although this type of casting equipment functions reasonably well, the quality of the cast product is, however, much poorer than that of equivalent vertical casting equipment in which, in addition to oil, gas is also supplied through the cavity wall.

One of the disadvantages of vertical casting equipment is that it comprises a large number of moulds. This makes it expensive to produce.

Moreover, the vertical equipment is only designed to cast specific lengths in a semi-continuous process. This also makes it expensive to operate.

Casting with horizontal casting equipment involves the use of only a few moulds and the casting takes place continuously. Suitable lengths of the cast product are cut off during the casting operation. The continuous, horizontal casting equipment is thus both cheap to produce and cheap to operate.

One aim of the present invention was to produce horizontal equipment for continuous casting of metal, in particular aluminium, with which the quality of the cast product is as good as the quality of the equivalent cast product with vertical casting equipment.

The equipment in accordance with the present invention is characterised in that gas in addition to oil is supplied through the permeable wall material and that annuli are arranged between the permeable wall material and the mould housing to distribute the gas/oil to the wall material and that the annuli are divided into sectors using plugs and are supplied with oil/gas via separate supply channels for each sector, whereby the supply of oil/gas may be differentiated around the circumference of the mould cavity.

Claims 2-5 define the advantageous features of the present invention.

The present invention will be described in the following in further detail by way of examples and with reference to the attached drawings, where:

Fig. 1 shows, in part, in an elevation, the casting equipment for continuous horizontal casting of long objects, for example aluminium billets.

Fig. 2 shows, in large scale, the mould shown in Fig. 1, a) in cross-section and b) in a longitudinal section.

As Fig. 1 shows, the casting equipment 1 in accordance with the present invention comprises an insulated metal reservoir or pool 2 and a mould 3. The pool 2 is provided with a lateral opening 4 to the mould 3, where a connecting ring 5 of thermally insulating material forms the transition between the pool and the mould 3. On its side, the mould is releasably attached to a holding device 6. Via a hinge link 7, it is possible to swing the holding device and thus the mould 3 from a position in which it is in contact with the connecting ring 5 to a swung-out position which makes it possible to remove (replace) or repair the mould.

The mould itself, which is shown in further detail in Fig. 2, comprises a two-part annular housing, of which a first main housing part 8 is provided with drilled holes 10,11 for the supply of oil or gas to interior, permeable cavity rings 12,13, while a

second housing part 9 is provided with an annular recess which forms a water cooling channel 14. The two housing parts 8 and 9 are held together by means of a number of screws 15. When they are screwed together, as shown in the figure, a diagonal gap 16 is formed between the two parts so that, during the casting operation, water flows from the channel 14 and through the gap 16 along the entire periphery of the cast product just outside the outlet of the cavity 17.

As mentioned, permeable rings 12, 13, which are physically separated from each other by a gasket, sealing material 18 or similar, are included. These rings form the wall in the cavity 17.

An important feature of the present invention is that the annuli 20 (see Fig. 2, b)) formed between the mould housing 8 and the rings 12, 13 are provided with plugs 21 (only 2 shown in the drawing) so that the annuli 20 are broken up into two or more sectors as required. In this way, the supply of both gas and oil can be differentiated along the circumference of the cavity. Such differentiation, in particular of the gas supply, is important in order to be able to achieve a good casting result.

Supply of gas to the mould cavity of horizontal casting equipment is not previously known. To enable drainage of excess gas and thereby avoid inclusion of gas in the cast metal product under the casting process a bore 29 is provided through the mould wall (the ring 12). The gas is led to an annulus outside the ring 12 and further through a bore in the housing 8 (not further shown) to the atmosphere or a suitable collecting tank or the like for the gas.

At the inlet of the cavity 17, there is a plate 19 of thermally insulating material ("hot-top") which is held in place using a retaining ring 22 via a screw connection 23.

As the wall of the cavity 17, i.e. the rings 12, 13, forms the primary cooling area during the casting operation, the area of the wall surface will represent one of the factors which determine the cooling of the metal.

The insulating plate 19 may, depending on the type of alloy and the primary cooling required, extend along the ring 12 (at 24) somewhat.

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As the plate can be easily detached, it will be easy to replace the plate and thus cast different types of alloy in the same mould.

Otherwise, the casting equipment in accordance with the present invention works as follows:

Liquid metal, for example aluminium, is poured into the pool 2 from a casting furnace or similar (not shown). The metal flows through the opening 4 and the holes 25, 26 in the plate 19 into the cavity 17.

At the beginning of the casting operation, the outlet 27 in the mould 3 is closed using a mobile casting shoe (not shown). As soon as the metal has filled the cavity 17, the shoe begins to move, while water is supplied through the gap 16 and gas and oil are supplied through the ring 12, 13.

As the casting shoe moves and the cavity is refilled with metal via the pool, a long casting piece is formed. The shoe is removed as soon as the casting piece has reached a certain length. Since the casting process is continuous, the casting piece may actually be of any length. However, it is expedient for the casting piece to be cut (not shown) into suitable lengths for extrusion or other purposes.

As mentioned above, the casting equipment is designed for differentiated supply of oil and gas around the circumference.

In particular regarding the supply of gas, it has been found expedient to supply the same quantity of gas around the entire circumference of the cavity at the start of the casting process. Subsequently, when the casting process has started and has become stable, the gas supply to the upper area of the cavity is reduced. Preferably, in this connection the annuli 20 for the supply of gas may be divided into two sectors, an upper and lower, by means of restrictions 21.

Moreover, regarding the primary cooling, i.e. the cooling through the rings 12, 13 in the cavity 17, it has been found expedient, in order to reduce the cooling, to make the mould housing 8 of steel instead of aluminium, which is the usual material. Furthermore, in order to reduce the cooling further, it may be necessary to shield (reduce the thermal transfer to) the cooling channel 14 by arranging an insulating annular plate 28, for example of Plexiglas, on the side of the housing part which faces the cooling channel.

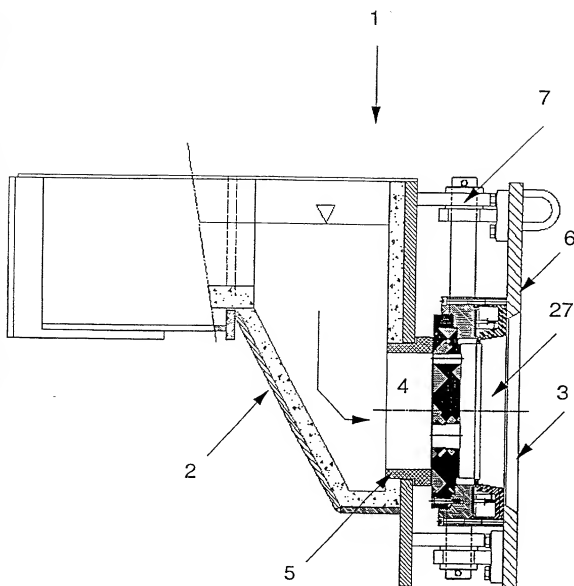
The invention as defined in the claims is not restricted to the embodiments shown in the drawings and described above, thus, instead of using two independent rings 12,13 just one ring may be employed for the supply of oil and gas through the same ring.

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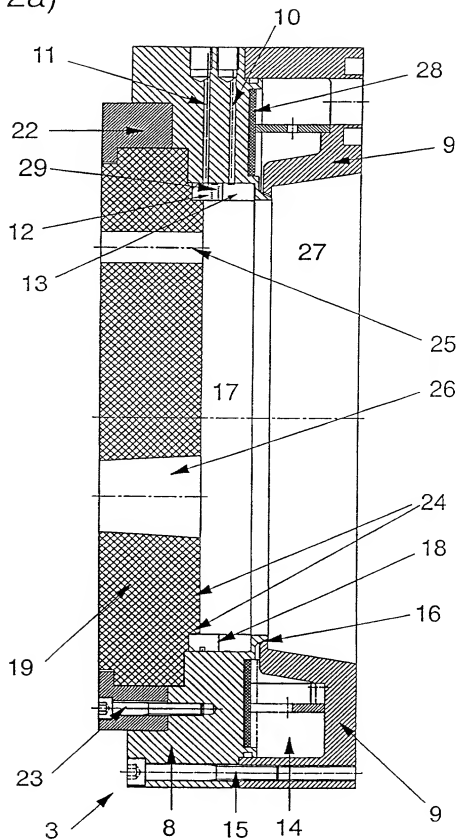
Fig. 1



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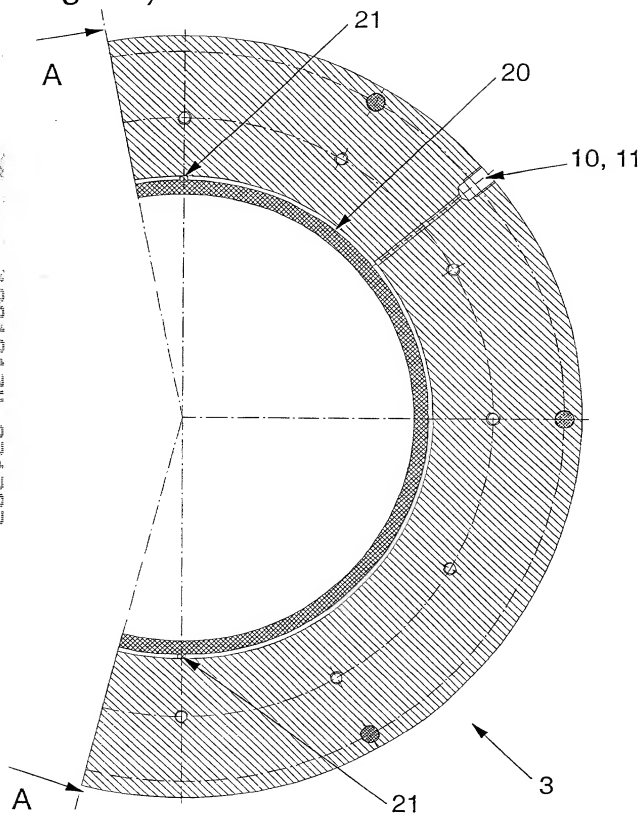
Fig. 2a)



Section A-A

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Fig. 2b)



DECLARATION AND POWER OF ATTORNEY FOR U.S. PATENT APPLICATION

() Original () Supplemental () Substitute ☒ PCT () Design

As a below named inventor, I hereby declare that: my residence, post office address and citizenship are as stated below next to my name; that I verily believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Title: "Equipment for continuous, horizontal casting of metal"

(derived from PCT/NO00/00221)

of which is described and claimed in:

- () the attached specification, or
 () the specification in the application Serial No. _____ filed _____;
 and with amendments through _____ (if applicable), or
 (x) the specification in International Application No. PCT/NO00/00221, filed June 26, 2000, and as amended
 on _____ (if applicable).

I hereby state that I have reviewed and understand the content of the above-identified specification, including the claims, as amended by any amendment(s) referred to above.

I acknowledge my duty to disclose to the Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, '1.56.

I hereby claim priority benefits under Title 35, United States Code, '119 (and '172 if this application is for a Design) of any application(s) for patent or inventor's certificate listed below and have also identified below any application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:


COUNTRY	APPLICATION NO.	DATE OF FILING	PRIORITY CLAIMED
Norway	19993157	June 25, 1999	Yes

I hereby claim the benefit under Title 35, United States Code '120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code '112, I acknowledge the duty to disclose information material to patentability as defined in Title 37, Code of Federal Regulations, '1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

APPLICATION SERIAL NO.	U.S. FILING DATE	STATUS: PATENTED, PENDING, ABANDONED

And I hereby appoint Michael R. Davis, Reg. No. 25,134; Matthew M. Jacob, Reg. No. 25,154; Warren M. Cheek, Jr., Reg. No. 33,367; Nils Pedersen, Reg. No. 33,145; Charles R. Watts, Reg. No. 33,142; and Michael S. Huppert, Reg. No. 40,268, who together constitute the firm of WENDEROTH, LIND & PONACK, L.L.P., as well as any other attorneys and agents associated with Customer No. 000513, to prosecute this application and to transact all business in the U.S. Patent and Trademark Office connected therewith.

I hereby authorize the U.S. attorneys and agents named herein to accept and follow instructions from _____, as to any action to be taken in the U.S. Patent and Trademark Office regarding this application without direct communication between the U.S. attorneys and myself. In the event of a change in the persons from whom instructions may be taken, the U.S. attorneys named herein will be so notified by me.

Direct Correspondence to Customer No:  000513 PATENT TRADEMARK OFFICE	Direct Telephone Calls to: WENDEROTH, LIND & PONACK, L.L.P. 2033 "K" Street, N.W., Suite 800 Washington, D.C. 20006-1021 Phone: (202) 721-8200 Fax: (202) 721-8250
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Residence & Citizenship	CITY	STATE OR COUNTRY	COUNTRY OF CITIZENSHIP
Post Office Address	ADDRESS CODE	CITY	STATE OR COUNTRY ZIP

I further declare that all statements made herein of my own knowledge are true, and that all statements on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Inge
 1st Inventor: Johansen _____ Date 19.12.01
 Geir
 2nd Inventor: Møland _____ Date 19.12.01
 Åge
 3rd Inventor: Strømsvåg _____ Date 19/12-01
 4th Inventor: _____ Date _____
 5th Inventor: _____ Date _____
 6th Inventor: _____ Date _____
 7th Inventor: _____ Date _____

The above application may be more particularly identified as follows:

U.S. Application Serial No. 10/018,174 Filing Date December 18, 2001

Applicant Reference Number P99048 SvH: AMH Atty Docket No. 2001-1826A

Title of Invention EQUIPMENT FOR CONTINUOUS, HORIZONTAL CASTING OF METAL

10018174.031202